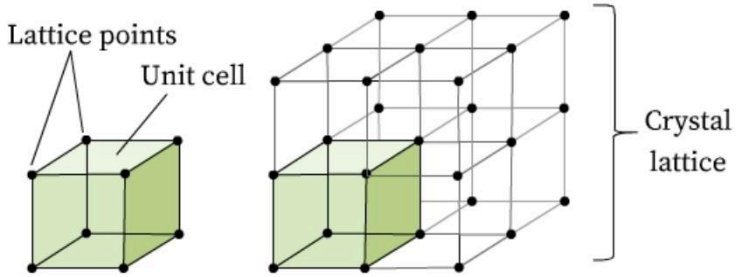
SPACE LATTICE OR CRYSTAL LATTICE

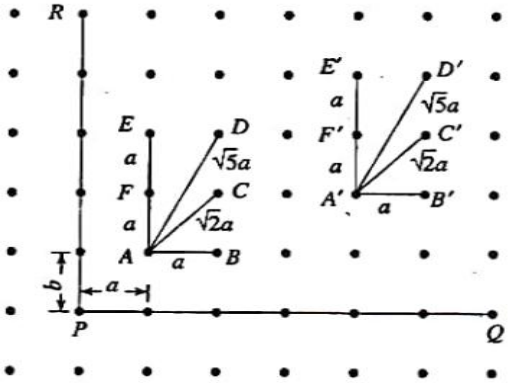
- **A lattice** is a regular and periodic arrangement of points in 3-D.
- **A Lattice point** is an imaginary point in space at an atomic or molecular site of the (actual) crystal.Each lattice point represents the position of an identical atom in the crystal.
- **Space Lattice:** An infinite array of points in 3-D space in which every point has an identical surroundings to that of every other point is called a space lattice.

OR

- A space lattice is a 3D arrangement of lattice points repeated periodically in space.
- A space lattice is otherwise called a crystal lattice.



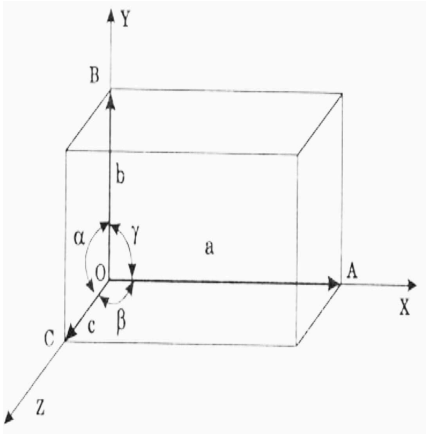
- It can be explained by considering three points P, Q, and R in 2D.
- Let us join the points P&Q by a straight line taken as the x-axis, and join P&R by another straight line taken as the y-axis.



- The distance between any two successive lattice points in the x-direction is taken as 'a' and the y-direction is taken as 'b'. Here 'a' and 'b' are said to be "Lattice translational vectors" (and a=b in a square lattice) shown in the figure.
- Consider two sets of points A,B,C,D,E,F and A',B',C',D',E',F' in which the surrounding environment looks symmetrical; i.e., the distances A&A', B&B', C&C', D&D', E&E' and F&F' are equal.
- Therefore, if the surrounding environment looks the same when the arrangement is viewed from different lattice points, then that arrangement is said to be a space lattice.

LATTICE PARAMETERS

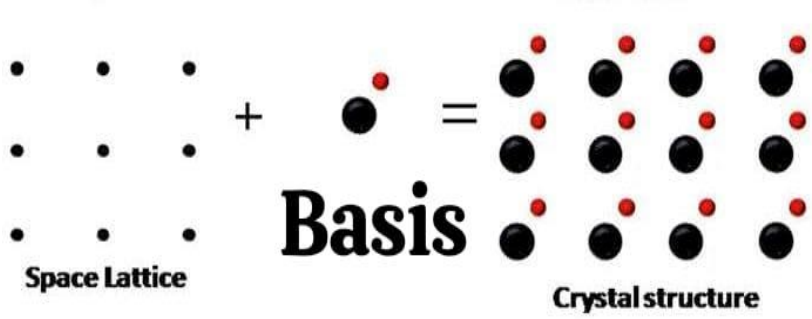
- The three interfacial angles and their three corresponding primitives are essential to represent a lattice. These six parameters are called lattice parameters.
- Let us consider the unit cell consisting of three mutually perpendicular edges OA, OB, and OC.



- Draw lines along the three edges, which are taken as **crystallographic axes** and are denoted by x, y, and z axes.
- The intercepts OA, OB, and OC made by the unit cell along the x, y, & z axes are represented $\vec{a}$,$\vec{b}$ &$\vec{c}$ respectively and are known as **primitives**.
- The angles between y and z, z and x, and x and y axes are denoted by α,β & γ respectively, and are called **interfacial angles** or **interaxial angles**.
- These six parameters$\vec{a}$,$\vec{b}$,$\vec{c}$,α,β & γ are called **lattice parameters**. They give the size and shape of the unit cell.

BASIS (OR) PATTERN (OR) MOTIF

- A group of atoms or molecules associated with every lattice point in the space lattice is called a **basis**.
- When the basis is repeated with correct periodicity in all directions, it gives the actual crystal structure.
- The basis provides the number of atoms/molecules, their mutual orientations, and distances of separation. Thus, a lattice combined with a basis generates the crystal structure.



- Here, the crystal structure is real, while the lattice is imaginary.